


INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P16671-ATO		FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/EP 02/10672	International filing date (day/month/year) 24.09.2002	Priority date (day/month/year) 24.09.2002	
International Patent Classification (IPC) or both national classification and IPC H04L1/18			
Applicant TELEFONAKTIEBOLAGET LM ERICSSON (PUBL)			
<p>1. This International preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 6 sheets.</p>			
<p>3. This report contains indications relating to the following items:</p> <p>I <input checked="" type="checkbox"/> Basis of the opinion</p> <p>II <input type="checkbox"/> Priority</p> <p>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p>IV <input type="checkbox"/> Lack of unity of invention</p> <p>V <input checked="" type="checkbox"/> Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI <input type="checkbox"/> Certain documents cited</p> <p>VII <input type="checkbox"/> Certain defects in the international application</p> <p>VIII <input type="checkbox"/> Certain observations on the international application</p>			
Date of submission of the demand 02.04.2004		Date of completion of this report 23.12.2004	
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International application No. PCT/EP 02/10672

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, Pages

1, 2, 4-22 as originally filed
3, 3a received on 07.10.2004 with letter of 05.10.2004

Claims, Numbers

1-12 received on 13.11.2004 with letter of 12.11.2004

Drawings, Sheets

1-3 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

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5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-13
	No: Claims	
Inventive step (IS)	Yes: Claims	1-13
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-13
	No: Claims	

2. Citations and explanations

see separate sheet

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EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/EP 02/10672

I

The present application relates to a method, a transmitter and a receiver for transmission of data employing ARQ.

The closest prior art is represented by document D1 (PROTECTING DISTORTION-TOLERANT DATA BY AUTOMATIC REPEAT REQUEST (ARQ) DISCLOSED BY ERICSSON INC" IBM TECHNICAL DISCLOSURE BULLETIN, IBM CORP. NEW YORK, US, vol. 39, , no. 12, 1 December 1996 (01-12-1996), page 173) disclosing a method of transmission (the corresponding features in D1 are given in brackets), wherein the receiver performs a check whether received data is erroneous (second paragraph, first sentence) and wherein the transmitter performs further data transmission according to said check (last sentence), with the following steps being performed:

- determining a reliability measure for the received data (second paragraph, first sentence: *"the receiver estimated the number of transmission errors impressed on the block of data"*),
- performing a comparison of the reliability measure to a reliability threshold (second paragraph, last sentence: *"the receiver then compares the estimated number of transmission errors with the maximum permissible number of such errors as specified by the threshold"*),
- performing the further data transmission according to the result of the comparison (last sentence: *"when the estimated number of transmission errors meets or exceeds the threshold, the data block is deemed unreliable, and corrective measures are enabled in accord with well-known ARQ algorithms"*).

The difference between the subject-matter of claim 1 and the disclosure of D1 is that according to claim 1 the reliability measurement is aggregated for at least a part of the service data unit corresponding to the next higher protocol layer and that the decision to retransmit is based on this aggregated reliability measure. Furthermore, only the transmitted data detected to be in error is retransmitted rather than the whole sequence of data from which the reliability measurements have been aggregated.

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The objective technical problem could be viewed as achieving a more efficient way to control whether a retransmission is necessary. The skilled person, in the context of D1, wherein the reliability threshold is based on the relative importance of the data, would realize that the relative importance of the data is the same for several packets in a row belonging to the same type of information and included in a service data unit from a higher order protocol rather than to each individual packet. He would therefore decide to calculate whether a retransmission is necessary based on a reliability measurement for this group of packets. It is however not suggested neither in document D1, nor in the other documents cited in the international search report (i.e. US 2001/052104 A1 and US 6145108 A) the particular way in which these reliability measurements are calculated according to claim 1, i.e. by aggregating the reliability measurements of individual packets, nor how to proceed with the retransmission, i.e. by retransmitting, not the whole set of packets from which the reliability measurement is below the minimum threshold, but only the packets detected to be erroneous. Although such an approach could have been taken by the skilled person, it is not clear that he would have been prompted specifically to this solution.

Therefore, an inventive step for the subject-matter of claim 1 is acknowledged when departing from document D1. Independent claim 1 meets thus the requirements of Article 33 PCT.

II

Independent claims 10 and 11 claim protection for the same technical aspect as claim 1 in terms of the corresponding receiver and transmitter features and claim 12 defines a program unit comprising software to perform the steps of the method defined in claim 1. Therefore, claims 10, 11 and 12 also satisfy the requirements of Article 33 PCT

Dependent claims 2-10 contain further details of the method of claim 1. As they are dependent on claim 1, they also satisfy the requirements of Article 33 PCT.

transmission errors, which avoids overprotection of the information by much FEC or excessive transmission power.

In data communications, applications and protocols are getting increasingly
5 important which are able to cope with a certain amount of errors, e.g. by
performing error correction, error detection, by applying error concealment
techniques or any combination of such methods. Error tolerant applications are
for example customary for video, audio or speech transmission. However,
present transport protocols in the Internet, like TCP (Transport Control Protocol)
10 or UDP (User Datagram Protocol) are not adapted to error-tolerant applications.
TCP is suited especially for applications, which require error free transmission
without strict delay-bounds. UDP can discard erroneous data packets but does
not guarantee reliable data transmission and is used for example for streaming
applications with delay requirements. For the transmission of data to error-
15 tolerant applications within the Internet, the UDP Lite protocol has been
proposed as a further Internet Standard. The UDP Lite protocol does not
automatically discard data packets, in which transmission errors are detected
but can forward them to the application, which can in turn apply an error
correction or concealment on the application layer.

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The article "Protecting distortion-tolerant data by automatic repeat request
(ARQ)" disclosed by Ericsson Inc. in IBM Technical Disclosure Bulletin, Vol. 39,
No. 12, Dec. 1996, page 173, IBM Corp., New York, USA discloses a method
for sending data over a noisy transmission channel. The receiver estimates the
25 number of transmission errors in a data block and compares it to a threshold for
the maximum permissible number of errors, which may be defined with respect
to the importance of a data block. Below the threshold, the block is deemed
sufficiently reliable while else corrective measures are enabled in accord with
ARQ algorithms.

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Patent application US 2001/052104 concerns a decoder using iteration
calculations in decoding convolutionally coded signals using a local quality

index. The iterations are terminated when the quality does not reach a threshold and in this case a retransmission of the corresponding signal portion is requested.

- 5 Patent US 6145108 proposes to recombine ARQ retransmission signals with information from previously failed transmissions of the same signal. The receiver sends an ARQ signal to the transmitter when the output signal is deemed unreliable in order to increase the likelihood that a successful transmission is quickly achieved. The number of allowable retransmissions may
- 10 be set on a per service basis.

However, for the prior art methods, the transmission efficiency remains limited and the advantages of error-tolerant applications and protocols can at most partly be exploited.

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Summary and description of the invention

- 20 It is an object of the present invention to obviate the above disadvantages and provide a method for an effective data transmission in a protocol allowing transmission errors.

According to the invention, the method described in claim 1 is performed.

- 25 Furthermore, the invention is embodied in devices and computer programs as

Claims

- 5 1. A method for the transmission of data from a transmitter (ST) to a receiver (SR), wherein a first protocol in the receiver (SR) performs a check whether received data (DP) is erroneous and wherein the transmitter (ST) performs a further data transmission according to said check, and the first protocol processes the received data (DP) and passes a service data unit to the next
- 10 higher protocol layer, wherein the following steps are performed:
- determining a reliability measure (RM) for the received data (DP),
 - aggregating the reliability measure for at least a part of the service data unit,
 - performing a comparison of the aggregated reliability measure (RM) to a
 - 15 reliability threshold (RT),
 - performing the further data transmission according to the result of the comparison for data (DP), which is detected as erroneous.
- 20 2. The method according to claim 1, wherein the receiver (SR) requests the further data transmissions according to the comparison.
3. The method according to claim 1 or 2, wherein the reliability measure (RM) is determined for a selected part of the received data (DP).
- 25 4. The method according to any preceding claim; wherein at least one further condition determines whether the further data transmission is performed.
5. The method according to claim 4, wherein at least one second reliability threshold is defined and wherein a decision is performed to continue further
- 30 data transmissions until a selected one of the reliability thresholds is achieved.

6. The method according to any preceding claim, wherein the receiver (SR) sends reliability information (RI) indicating an error level of the received data (DP) to the transmitter (ST).
- 5 7. The method according to any of the claims 2 to 6, wherein an optional retransmission request is defined in the first protocol, the receiver (SR) sends the optional retransmission request if the reliability measure (RM) is at least equal to one of the reliability thresholds (RT), and wherein the transmitter (ST) performs a decision, whether a further data transmission is
10 performed in reply to the optional retransmission request.
8. The method according to any preceding claim, wherein the transmitter (ST) sends a reliability requirement to the receiver (SR) and the receiver (SR) selects the reliability threshold according to the reliability requirement.
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9. The method according to any preceding claim, wherein the reliability measure (RM) is provided to a higher protocol layer (AP) or an application and the processing of the higher protocol layer (AP) or the application is adapted according to the reliability measure (RM).
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10. A receiver for data sent by a transmitter (ST), wherein the receiver (SR) has a receiving unit (TRU) for the data (DP) and for forwarding said data (DP) to a processing system (PRU), wherein the processing system (PRU) is adapted to perform a check in a first protocol whether received data (DP) is
25 erroneous and the first protocol processes the received data (DP) and passes a service data unit to the next higher protocol layer, and wherein the receiver (SR) has a transmission unit adapted to send a request to the transmitter (ST) for a further data transmission according to said check, wherein the processing system (PRU) comprises a unit for determining a
30 reliability measure (RM) for the received data (DP) and for aggregating the reliability measure for at least a part of the service data unit, the processing system (PRU) comprises a unit for a comparison of the aggregated reliability

measure (RM) to a reliability threshold (RT), and the processing system (PRU) is adapted to initiate the request for the further data transmission according to the result of the comparison for data (DP), which is detected as erroneous.

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11. A transmitter with a transmission unit for sending data (DP) to a receiver (SR), in which receiver a first protocol processes the received data (DP) and passes a service data unit to the next higher protocol layer, the transmitter having a receiving unit for receiving requests from the receiver (SR) for a further transmission of sent data, and a processing system for storing the sent data and for retrieving the stored data according to the requests and initiating a further data transmission by the transmission unit, wherein the processing system comprises a unit for determining a reliability measure (RM) for the data received by the receiver (SR) and for aggregating the reliability measure for at least a part of the service data unit, the processing system comprises a unit for a comparison of the aggregated reliability measure (RM) to a reliability threshold (RT), and the processing system is adapted to initiate the further data transmission according to the result of the comparison.

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12. A program unit for controlling the transmission of data (DP) from a transmitter (ST) to a receiver (SR), wherein a first protocol in the receiver is adapted to (SR) perform a check whether received data (DP) is erroneous and the first protocol is adapted to process the received data (DP) and to pass a service data unit to the next higher protocol layer, and wherein the transmitter (ST) is adapted to perform a further data transmission according to said check, wherein the program unit comprises software code adapted to perform the steps of:

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- obtaining a reliability measure (RM) for the received data (DP),
- aggregating the reliability measure for at least a part of the service data unit,
- performing a comparison of the aggregated reliability measure (RM) to a

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reliability threshold (RT),

- initiating the further data transmission according to the result of the comparison for data (DP), which is detected as erroneous.

AMENDED SHEET